

The Impact of Poor Oral Health on School Performance for Children in North Carolina

by

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ABSTRACT
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The Impact of Poor Oral Health on School Performance for Children in North Carolina
Under the direction of William F. Vann Jr, DMD, PhD

Purpose: To examine the difference in missed school days related to routine dental care versus dental pain/infection and to determine the relationship between children's oral health status (OHS) and school attendance and performance.

Methods: We relied upon the 2008 North Carolina (NC) Child Health Assessment and Monitoring Program, a statewide telephone survey. Variables included outcome—school absence and performance; explanatory—OHS; control—parental education, insurance, race, and sex. We used logistic regression models and mediation analysis.

Results: The final sample included 2,183 schoolchildren, weighted to reflect the state's census. Children with poorer OHS were nearly 3 times more likely (OR=2.89, 95% CI 1.96, 7.75) to miss school for dental pain. Absence for pain was associated with poorer performance ($P<.05$) but absence for routine care was not. Mediation analysis revealed that OHS was significantly associated with performance, independent of absence for pain.

Conclusions: Children with poorer OHS were more likely to experience dental pain and miss school and more likely to have poorer school performance. These findings suggest that improvement of children's OHS may be a vehicle to improve their educational experience.

DEDICATION

I dedicate my thesis to my husband, Alfred Jackson, for his unwavering support and love. I give my deepest expression of love and appreciation for his encouragement and patience, and thank him for being my best friend and a constant source of happiness.

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LIST OF ABBREVIATIONS

BRFSS: Behavioral Risk Factor Surveillance Survey

CDC: Centers for Disease Control

CHAMP: Child Health Assessment and Monitoring Program

NHANES: National Health and Nutrition Examination Survey

NHIS: National Health Interview Survey

BACKGROUND AND SIGNIFICANCE

Oral Health is an Integral Dimension of Children's Overall Health

It is well-established that oral health is a fundamental component of general health. As a policy talking-point in the early 1980s, former United States (US) Surgeon General (1981-89) C. Everett Koop recognized the relationship between oral health and overall health and coined the often repeated quote “You’re not healthy without good oral health.” Later Surgeon General Dr. David Satcher reinforced this concept by focusing national attention on oral health by way of a Surgeon General’s Conference as chronicled in *Oral Health in America: a Report of the Surgeon General*¹ in which he stated “You cannot be healthy without good oral health.” This report explicates the role of oral health in overall health, emphasizing that oral health is a mirror for general health, with the oral cavity as a portal for infectious organisms. Recently established associations have been found between oral infections and diabetes,² heart disease,³ stroke,⁴ and low birth weight babies.⁵ In addition to the connection between oral and systemic health, oral health strongly influences quality of life and general well-being. Dental disease in children can lead to serious general health problems and significant pain, interference with eating, overuse of emergency rooms, and lost school time.¹

Several chronic diseases are known to affect children, requiring significant adjustments in life management and decreased quality of life to varying degrees. The National Institute of Health estimates that chronic health conditions occur in 20-30% of children and adolescents in the US.⁶ Among the most prevalent diseases of childhood are

dental caries, asthma, diabetes, and obesity. How does the prevalence and impact of dental caries compare to the chronic childhood diseases of asthma, diabetes, and obesity? In fact, dental caries is the most common chronic disease of childhood, occurring five to eight times more than asthma.¹ According to the National Health and Nutrition Examination Survey Report (1999-02), 41% of children aged 2-11 had dental caries in their primary teeth and 42% of those aged 6-19 years had dental caries in their permanent teeth.⁷ The percentage with filled and unfilled cavities did not decrease between 1986 and the release of *Healthy People 2000*; indeed, the percentage of children who saw a dentist before kindergarten actually decreased during this time-frame.⁸

The need for dental care is also a parental concern. According to 1996 data from the National Center for Health Statistics, when parents reported unmet health care needs for their child, 57% of the time the unmet need was for dental care.⁸ Evidence also suggests that children with dental caries have poorer oral health quality of life.^{9, 10} In summary, dental caries is a chronic childhood disease. It occurs in a large percentage of children and can negatively impact their general health and quality of life.

Dental Caries among Children in North Carolina (NC)

In 1999, 36% (~31,000) of children entering kindergarten in NC had experienced dental caries with over 21,500 having untreated caries.¹¹ In 2005-06, 40% of children entering kindergarten had experienced dental caries with approximately 21% having untreated caries.¹² Relative to the surveillance of dental caries among school-aged children, the NC Department of Health and Human Services conducts a statewide epidemiological School Oral Health Survey every 15 years. Data collected in 1986-87 revealed that 47% of all 5-17 year olds had experienced cavities in their permanent teeth. This figure increased

significantly with age; by age 17, over 83 % of school-aged children had some caries, with an average of 8.44 DMFS per child.¹² The most recent survey in 2003-04¹³ found that 56% of children ages 5-17 experience caries in either primary or permanent teeth with a mean DMFS of 4.4 for children 6-17 years old. Relative to dental pain-related experiences, the survey found that 24% of children in kindergarten-third grade had experienced dental pain in their lifetime and 31% of children in grades 4-12 had experienced dental pain at least one time in the last three months. While mean DMFS scores decreased between 1986-87 and 2003-04, the prevalence of caries in primary teeth actually *increased* in certain groups. Reflecting perhaps a more serious problem, the amount of untreated decay did not change appreciably over this time-frame.¹³ In summary, it is well-documented that NC children have a high burden of dental disease and many report related dental pain.

Children's Oral Health and School Attendance

Children with dental caries are not healthy and may be at a disadvantage for their physiologic, social, and mental development. This is a concept that has received attention by both investigators and policy makers. In her 2001 keynote address at the American Academy of Pediatric Dentistry Annual Session, former Surgeon General Antonia Novello noted “We know that children who can’t eat well can’t sleep, and are constantly hurting will become failures to thrive-becoming underweight, undernourished, and as a consequence, undereducated, underachievers.”¹⁴

Reisine noted that the National Health Survey (NHIS) documented that 1.57 million school days were lost in 1980 due to dental problems.¹⁵ Using 1984 NHIS data, Waldman reported that children under 18 years old had approximately five million restricted activity days, more than 1.6 million days in bed, and more than 1.7 million missed school days due to

acute dental conditions.¹⁶ A number commonly quoted in the literature is that over 51 million school hours are lost annually because of dentally-related illness,^{1, 17-25} a statistic emanating from the 1989 NHIS data.

The 1989 NHIS was unique in that it included an oral health care supplement for individuals older than age two and for the first time, included questions about missed school and work as well as about reduced normal activity due to a dental visit or problem. Gift and colleagues analyzed this dataset and arrived at the figure of over 51 million hours of school missed annually and found also that 3,865,001 restricted activity days were reported for children up to 18 years old.¹⁸ The question asked the respondents “whether, in a two-week period preceding the interview, anyone in the respondent’s family missed any time from or school because of a dental problem or visit?” However, the question did not specify whether the visit was preventive, restorative, emergency, or trauma-related.²⁶ For this reason, it is impossible to disentangle the nature of the dental visit that resulted in the school absence or restricted activity.

Children’s Oral Health and School Performance

There are no published US data examining oral health and *school achievement or performance*. Several international studies have examined this relationship with the aim of using poor school performance as a proxy measure for dental treatment need.²⁷⁻³² Generally these studies have found positive correlations between oral health status and school performance, but the results are limited in their generalizability in the US because educational systems are vastly different from country to country relative to school days per year, length of school days, utilization of school-based dental clinics, and other cultural factors.

Children's Oral Health and School Performance—a NC Perspective

It is well-documented that children in NC follow the national trend and have a high burden of dental disease, with many reporting related dental pain.^{12, 13, 33} We undertook a study during 2006-07³⁴ with the general aim of examining health factors that affect school performance in NC children as well as the impact of poor oral health status on school performance, while controlling for other health and socio-demographic factors. We relied upon the 2005 Child Health Assessment and Monitoring Program survey (CHAMP), a NC statewide phone interview of households. This contemporary dataset offered the potential to address the relationship of dental disease to children's school performance because it included sections on oral health and school performance. In a statewide representative sample of 3,000 families, we tested four different dimensions of overall health including: 1) both poor oral and general health, 2) poor oral and good general health, 3) good oral and poor general health, and 4) both good oral and general health. Parents of children with both poor oral and general health were 2.3 times more likely to report poor school performance than those with both good oral and general health (95% CI 1.07, 5.67). This significant increase in the likelihood for parentally reported poor school performance when a child had poor oral health in addition to poor general health underscored the impact that the additional burden of poor oral health may have on school performance.

These findings add to the knowledge base of the relationship between poor general health and school performance but do not implicate oral health as a stand-alone factor in poor school performance. More study is needed to assess school absence related to oral health visits, and specifically the types of oral health concerns that contribute to school absence. It is also essential to learn whether untreated dental disease affects a child's learning

capabilities when they are present in school. With this backdrop, the overarching goal of this investigation was to examine the impact of poor oral health status on school performance in a more detailed manner, assessing which oral health problems were most burdensome to the learning environment, causing both school absence and decreased learning potential when present in school. Our conceptual and theoretical framework for the study is illustrated in Figure 1.

SPECIFIC AIMS

The specific aims of this study were:

- 1) To document school absence related to routine dental care;
- 2) To document school absence related to dental pain and infection, also comparing this school time lost with time lost due to general illness and injury and other chronic conditions such as asthma;
- 3) To assess the extent to which the child's oral health status is related to children's school attendance; and
- 4) To assess the extent to which the child's oral health status is related to children's school performance.

MATERIALS AND METHODS

Study Design and Data Source

The Internal Review Board of the NC Center for Health Statistics approved this study, which relied upon data from the 2008 Child Health Assessment and Monitoring Program (CHAMP) in NC. CHAMP is a follow-up to the NC Behavioral Risk Factor Surveillance Survey (BRFSS), a federally-mandated annual survey for all states and supported by the CDC for adults 18 and older. Each state must complete an annual core BRFSS survey in such a manner that the surveys are constantly under collection at any time in any given state. It should be noted that BRFSS does not have a child health component; however, as follow-up to the 2005 BRFSS in NC, the State Center for Health Statistics developed the CHAMP to explore a wide range of child health issues, including 26 sections ranging from general health to birth characteristics, sun safety and adolescent sexuality. CHAMP has been administered annually in NC since 2005. It includes separate sections on both oral health and school performance. The oral health section includes five questions and the school performance section includes three questions (Figure 2).

CHAMP data collection works as follows: when an adult in a household is identified by random sample to complete the BRFSS, the adult is asked if she or he has children less than 18 years of age residing in the household. If so, the respondent is asked to participate in CHAMP. If he/she agrees and there is more than one child in the home, one is chosen for the survey by computer randomization. The respondent most familiar with the child's health is

called to the phone to complete the 15-20 minute phone interview. A probability sample of households is used, with racial and ethnic minorities sampled to ensure adequate representation with reliance on the US Census model.

Variable Measurement

Parental perception of the child's oral health status was analyzed in relation to school attendance and school performance. School performance was measured by the question, "How would you describe (CHILD'S) grades in school over the past 12 months? Would you say they were mostly A's, B's, C's, D's, or F's?" For the purposes of this investigation, we defined poor school performance as those with mostly C's, D's, or F's. By adding two new questions in the oral health section of CHAMP 2008, we were able to directly assess school absence related to routine dental care and dental pain/infection. These questions asked "During the past 12 months, about how many days did your child miss school because of routine dental care (such as check-ups, fillings, etc.) or orthodontic visits?" and "During the past 12 months, about how many days did your child miss school because of a tooth ache, dental infection, or related 'dental fever'? Include time spent at home not feeling well and time receiving dental care for the problem."

Our major explanatory variable was the child's oral health status as reported by the household adult. The child's oral health status was measured by the question, "How would you rate the condition of (CHILD'S) teeth? Would you say their condition is: Excellent, Very Good, Good, Fair, or Poor?"

Two general health variables were included: "general health status (excellent, very good, good, fair, and poor)" and "if the child has special health care needs (yes, no)." In addition, we controlled for the following variable: child's sex (male, female), race (white,

minority), ethnicity (Hispanic, Non Hispanic), age (<5 yrs, 5-11, 12-14, >14), highest level of education achieved in household (less than HS, HS, some college, four year degree plus), and insurance status (public insurance, military/other, private insurance, uninsured).

Data Analysis

After examination of descriptive statistics and bivariate associations of independent variables and school performance, multivariable logistic regression models were used to test the relationship of oral health status, school performance, and school attendance, while accounting for control variables. Considering the potential for dental and general health variables to be highly correlated with the school absence variables, we estimated logistic regression models after excluding each of these variables to further examine their relationship with poor school performance.

Mediation analysis was performed to test whether school absence for dental pain was a mediator between oral health status and poor school performance.

We used appropriate analytic weights provided by the NC Center for Health Statistics to account for the complex survey design and for non-response and non-coverage of households without telephones. All analyses were conducted using Stata version 10 (StataCorp, College Station, TX).

RESULTS

Descriptive Results

Of the NC BRFSS sample with a child in the household, 3,865 (64.7%) agreed to participate in the CHAMP survey and 2,987 (77.3%) completed the interview. Eliminating those not in public or private schools reduced the sample size to 2,183 respondents. Eliminating the missing or “don’t know/not sure” responses further reduced the sample to 2,120. Because one goal was to examine school performance, we limited our analyses to children in kindergarten or higher and in public or private school using a letter grading system. The final sample included 1,782 children, weighted to reflect the state’s census.

Most of the children were male (51.7%), between the ages of 5 and 11 (51.6%), white (63.1%), and covered by private health insurance (60.3%). A substantial majority of parents reported their children to have excellent or very good oral health status and excellent or very good general health status (Table 1).

Of the 2,120 children, 1,656 (78.1%) missed no school days for routine dental care, while 464 missed one or more days: 273 (13%) missed one day, 127 (5.9%) two, and 64 (3.0%) three or more (Table 2). In comparison, 2,031(96.1%) missed no school days because of dental pain/infection, while 89 missed one or more days: 50 (2.2%) missed one day, 18 (0.9%) two, and 21 (0.9%) three or more days (Table 3).

A total of 1,049 school days was missed by 2,120 children for any dental reason, an average of 0.49 days per child. Of these missed days, 182 days (17.3%) were missed for dental pain/infection (Figure 3). Comparatively, 9,166 school days were missed due to general

illness/injury by the 2,120 children, an average of 4.32 days per child. CHAMP 2008 also included a question targeted to children *currently diagnosed* with asthma (N=218), asking parents the days of school missed due to their asthma. A total of 477 days was reported for absence to asthma, an average of 0.23 days per child for the total sample.

Analytic Results

The results of the bivariate analyses examining factors associated with poor school performance revealed that gender (male), race (non-white), age (older), parent's educational level (less than high school or high school), health insurance status (public, military/other, or uninsured), special health care needs (yes), general health status (good/fair/poor), and dental health status (good/fair/poor) were significantly related to poor school performance ($p < 0.05$). Bivariate analysis of school absence for routine dental care and poor school performance revealed no significant relationship (Table 2); however, school absence secondary to dental pain/infection was significantly related ($p = 0.001$) to poor school performance (Table 3). Multivariate results examining school absence for dental pain/infection and routine dental care are illustrated in Table 4. Having public assistance or no health insurance was significantly related to absence for dental pain/infection. Children with good/fair/poor oral health were nearly three times more likely to miss school for dental pain versus those with very good/excellent oral health. Black children were significantly less likely to miss school for routine dental care than whites.

The variables significantly associated with poor school performance in the multivariate analysis (Table 5) included gender (male), race (black), grade in school (grades 6-12), parental level of education (high school), insurance (public), and special health care needs (yes). When both health status and school absence variables were included in the

model, children with good/fair/poor oral health status were more likely to have poor school performance (OR=1.62, 95% CI 1.10, 2.38). This relationship held even when school absence variables were excluded from the model (OR=1.70, 95% CI 1.16, 2.49). Excluding health status variables from the analysis revealed that children who missed school for dental pain were more likely to have poor school performance (OR=1.94, 95% CI 1.04, 3.63).

Mediation analysis results revealed that absence for dental pain was not a mediator between oral health status and poor school performance, rather there is a significant association between oral health status and school performance independent of absence for dental pain.

DISCUSSION

The association of poor oral health and school attendance is a concept used frequently as an advocacy talking-point with policy makers and legislators. However, US school attendance data emanate from the 1980's and are outdated.¹⁵⁻²⁵ Existing data also fail to differentiate between routine visits and those related to pain/infection.^{18, 26} This study used a contemporary dataset (CHAMP) including detailed questions regarding oral health and school performance, offering a snapshot of school absence for dental reasons while also differentiating between absence for routine dental visits and absence due to pain/infection. Our new questions directly assessed the number and cause of school days missed because of routine dental visits and dental problems, providing novel data to clarify the relationship between school absence and school performance.

Our first two aims were to document school absence related to routine dental care and to dental pain/infection. The 1989 NHIS dataset that produced the commonly quoted 51 million hours of school missed annually for dental reasons asked the survey participant to recall time missed in a specified two week period; therefore, this dataset is likely an underestimation of school time lost¹⁸ and not directly comparable to our dataset. Additionally, the NHIS is a national dataset with an N of 109,603 while our dataset is statewide with an N of 2,120. If we assume an average of seven hours per day of school, our sample missed 7,343 hours of school for dental reasons and 1,274 hours specifically for dental pain/infection. While a relatively small percentage (~4%) of our sample missed school for dental pain/infection, it is important to consider the gravity of the effects on school

attendance along with school performance. Missing school for dental pain and infection was significantly associated with parental report of poor school performance, while school absence for routine dental care was not. This underscores the likelihood that school absence is not a stand-alone factor in the consideration of school performance. These findings (from the logistic model) provide further evidence that a child experiencing pain/infection may have a diminished educational experience because the pain may inhibit his or her ability to concentrate and learn when present in school.

Our third aim was to assess the extent to which children's oral health status is related to school attendance. There exists in the literature outdated figures for how much school is missed for dental causes¹⁵⁻²⁵; however, our review of the literature did not produce any existing analysis of the relationship between oral health status and school attendance. After controlling for other variables, we found that the worse the oral health status, the higher the likelihood for school absence for dental pain/infection. In fact, a child with good/fair/poor oral health status was nearly three times more likely (OR=2.89, 95% CI 1.96, 7.75) to be absent for dental pain/infection versus a child with very good/excellent oral health. This supports the concept that a child with poor oral health is more likely to experience pain/infection that may have a negative impact on his or her school attendance.

Our final aim was to examine the extent to which a child's oral health status is related to school performance. While it is documented in the literature that chronic illness can interfere with a child's success in school^{35, 36} and that dental caries may put a child at a disadvantage for their overall development¹⁴⁻¹⁶, a relationship between oral health status and school performance has not been previously evaluated in the literature. In the multivariate analysis, poor oral health was significantly related to the likelihood of poor school

performance. We estimated logistic regression models excluding health status and school absence variables to account for the potential for these variables to be highly correlated. Excluding the absence variables from the model still revealed a significant relationship between poor oral health and the likelihood of poor school performance. Further, without the health variables in the model, a significant relationship was found between school absence due to dental pain and poor school performance. These results show that having poor oral health with or without school absence variables in the model negatively impacts a child's performance in school. Additionally, when a child then misses school for dental pain/infection this also has a negative effect on school performance.

The mediation analysis revealed that school absence due to dental pain was not a mediating variable in the relationship between *good/fair/poor* oral health status and poor school performance. While missing school for dental pain may have an impact on school performance, there appears to be something fundamental in the relationship between oral health status and school performance, independent of attendance. These findings suggest that a child with poor oral health is more likely to have a diminished educational experience. We hypothesize that a child with poor oral health is more likely to have pain/infection that not only leads to school absence but also detracts from his or her ability to learn when he or she is present in school or studying at home.

Strengths and Limitations

This study used cross-sectional data, so no cause and effect relationships can be inferred. One limitation of a phone survey is a lack of representativeness of the population because those who do not have a land-line or are not listed publically are not sampled. However, we used survey weights that accounted for households excluded due to lacking a

telephone. Another potential limitation of this study is that the CHAMP data addressing school performance and dental health are subjective measures from the parent, although published data support the strength of such subjective reports. Talekar and colleagues analyzed data from NHANES III, finding a good correlation between presence of clinical disease and parent-defined need for dental treatment as well as perceptions of poor oral health.³⁷ Similarly, Jokovic and colleagues studied the level of agreement between mothers and children regarding the child's oral health-related quality of life, finding substantial agreement between the parent and child.³⁸ It also might be argued that parents' perceptions of academic performance are subjective, but several studies have examined the validity of parental reports of language and literacy development in preschool-aged children.³⁹⁻⁴¹ In the aggregate, these have found strong correlations between parents' perceptions and language development and academic achievement.

The strengths of this study include the wealth of child health information available in CHAMP and the detailed questions regarding oral health and school performance. Our new questions directly assessed the number and cause of school days missed because of routine dental visits and dental problems, helping to clarify the relationship between school absence and school performance, a concept not previously examined in the US.

CONCLUSIONS

This study provides updated information on school absence for dental visits by children in NC. An average of a 0.5 days/child was missed for dental reasons. Of all dental absenteeism, 17% was related to pain or infection. Although the numbers are not directly comparable due to the small sample size of patients with asthma (N=218), the average number of days missed from school due to asthma was approximately 0.2 days/child.

To further evaluate the school absence for dental reasons, it is important to consider not only the average number of days missed but the impact of absence. While only 17% of the dentally-related absenteeism was for pain/infection, this was found to increase the likelihood of poor school performance while absence for routine dental care did not. It is also important to consider the mechanism by which children's oral health affects their school performance. Those children with poorer oral health were more likely to have poor school performance, suggesting that dental disease may adversely affect performance independent of school absence.

POLICY IMPLICATIONS

The finding that almost 80 % of the children missed no school for routine dental visits may suggest that many children are not receiving routine preventive care, which could contribute to the frequency of absenteeism for dental pain/infection and inhibit learning while present in school. The increased odds ratio for school absence due to dental pain/infection when parents reported poorer health status further supports this concept. Accordingly, these findings have the potential to impact state and local school officials who set school attendance guidelines. School policies that restrict absenteeism for routine dental care may need to be reconsidered as a way to limit emergency needs that might accrue from postponing routine and preventive services.

In addition to updating school attendance data, our findings provide new evidence that poor oral health also affects school performance, providing contemporary and compelling data for pediatric dentists, policy-makers, oral health advocates, program-planners, and school administrators.

Table 1: Characteristics of Study Population

Variable			N = 2120	
			N	%
Child's Gender				
	Male		1,097	51.7
	Female		1,023	48.3
Child's Age				
	<5		50	2.9
	5-11		998	51.6
	12-14		499	22.1
	>14		573	23.4
Child's Grade in School				
	K-5		962	50.5
	6-8		474	21.7
	9-12		684	27.8
Race				
	White		1,466	63.1
	Black		334	23.0
	Other		320	13.9
Hispanic				
	Yes		191	10.1
	No		1,929	89.9
Parent's Educational Level				
	Less than HS		129	6.6
	HS		364	16.0
	College/Some College		1,627	77.4
Health Insurance Status				
	Public/Medicaid/Carolina ACCESS/IHS		512	24.2
	Private/Health Choice		1,291	60.9
	Military/Other		189	8.9
	Uninsured		128	6.0
Oral Health Status				
	Excellent/Very good		1,577	73.2
	Good/Fair/Poor		543	26.8
General Health Status				
	Excellent/Very good		1,744	82.1
	Good/Fair/Poor		376	17.9
Children with Special Health Care Needs				
	Yes		241	11.2
	No		1,879	88.8
School Performance				
	Mostly A's and B's		1,494	70.5
	Mostly C's, D's, and F's		288	13.6
	No letter grading		338	15.9
School Absence due to Routine Dental Care				
	1 Day		273	13.0
	2 Days		127	5.9
	3 or more Days		64	2.7
	No Days		1,656	78.4
School Absence due to Dental Pain				
	1 Day		50	2.2
	2 Days		18	0.9
	3 or more Days		21	0.8
	No Days		2,031	96.1

Table 2: School Days Missed for Routine Dental Care

Descriptive Statistics			Bivariate Analysis (N=1,782) Likelihood of Poor School Performance		
Days Missed	Frequency (N=2,120)	Percentage	%	F-stat	p
1	273	13.0	11.46	1.29	0.234
2	127	5.9	8.81		
3	26	1.2	2.97		
4	9	0.3	0.00		
5	12	0.5	0.18		
6	9	0.3	0.30		
7	2	0.1	0.00		
10	3	0.1	0.26		
12	1	0.05	0.00		
20	1	0.03	0.00		
23	1	0.01	0.00		
No Days	1,656	78.4	75.92		

Table 3: School Days Missed for Dental Pain and Infection

Descriptive Statistics			Bivariate Analysis (N=1,782) Likelihood of Poor School Performance		
Days Missed	Frequency (N=2,120)	%	%	F-stat	p
1	50	2.16	3.11	3.49	0.0014
2	18	0.87	1.49		
3	12	0.45	1.29		
4	1	0.04	0.28		
5	4	0.21	1.40		
7	2	0.05	0.11		
8	1	0.08	0.00		
10	1	0.03	0.00		
No Days	2,031	96.11	92.32		

TABLE 4: Logistic Regression Models for Likelihood of School Absence (N = 2120)

Variable	Likelihood of School Absence <i>Adjusted Odds Ratio (95% CI)</i>	
	Dental Pain	Routine Dental
Child's Gender Male vs. Female	1.46 (0.83, 2.56)	0.87 (0.67, 1.13)
Child's Grade in School Grade 6-8 vs. Grade K-5 Grade 9-12 vs. Grade K-5	0.72 (0.33, 1.60) 1.15 (0.59, 2.22)	0.85 (0.60, 1.20) 1.16 (0.86, 1.58)
Race Black vs. White Other vs. White	0.59 (0.30, 1.16) 1.40 (0.59, 3.31)	0.53 (0.35, 0.81) 1.37 (0.89, 2.12)
Hispanic Yes vs. No	1.90 (0.68, 5.36)	0.94 (0.54, 1.65)
Parent's Educational Level Less than HS vs. College/Some College HS vs. College/Some College	0.98 (0.32, 2.96) 0.74 (0.36, 1.51)	1.14 (0.59, 2.19) 1.15 (0.79, 1.69)
Health Insurance Status Public/Medicaid/Health Choice/CarolinaACCESS/IHS vs. Private Military/Other vs. Private Uninsured vs. Private	2.34 (1.15, 4.78) 2.20 (0.88, 5.51) 2.95 (1.21, 7.23)	1.69 (1.19, 2.41) 1.18 (0.74, 1.89) 0.97 (0.55, 1.71)
Special Health Care Needs Yes vs. No	0.57 (0.26, 1.24)	1.83 (1.24, 2.71)
Oral Health Status Good/Fair/Poor vs. Excellent/Very Good	3.89 (1.96, 7.75)	1.35 (0.99, 1.83)
General Health Status Good/Fair/Poor vs. Excellent/Very Good	1.39 (0.67, 2.88)	0.79 (0.55, 1.13)

TABLE 5: Logistic Regression Models for Likelihood of Poor School Performance

	Likelihood of Poor School Performance (N = 1782) <i>Adjusted Odds Ratio(95% CI)</i>		
Variable		<i>Exclude Health status Variables</i>	<i>Exclude Absence Variables</i>
Child's Gender Male vs. Female	1.88 (1.29, 2.72)	1.96 (1.35, 2.85)	1.88 (1.30, 2.71)
Race Black vs. White Other vs. White	1.82 (1.16, 2.86) 0.84 (0.44, 1.60)	1.89 (1.21, 2.95) 0.87 (0.46, 1.64)	1.84 (1.17, 2.89) 0.83 (0.44, 1.58)
Grade in School Grade 6-8 vs. Grade K-5 Grade 9-12 vs. Grade K-5	1.72 (1.05, 2.82) 2.74 (1.78, 4.22)	1.71 (1.05, 2.78) 2.58 (1.70, 3.92)	1.71 (1.05, 2.79) 2.72 (1.76, 4.19)
Parent's Educational Level Less than HS vs. College degree+ HS vs. College degree+	1.51 (0.62, 3.67) 2.25 (1.44, 3.51)	1.66 (0.68, 4.06) 2.41 (1.54, 3.76)	1.57 (0.66, 3.75) 2.22 (1.42, 3.47)
Hispanic Yes vs. No	0.98 (0.43, 2.23)	0.99 (0.44, 2.29)	1.00 (0.44, 2.29)
Health Insurance Status Public/Medicaid/HealthChoice/ CarolinaACCESS/IHS vs. Private Military/Other vs. Private Uninsured vs. Private	1.99 (1.20, 3.29) 1.79 (1.01, 3.16) 1.52 (0.77, 3.01)	2.03 (1.23, 3.35) 1.73 (0.97, 3.06) 1.63 (0.85, 3.12)	1.98 (1.20, 3.26) 1.80 (1.02, 3.18) 1.56 (0.79, 3.10)
Special Health Care Needs Yes vs. No	3.62 (2.27, 5.78)	3.68 (2.37, 5.72)	3.55 (2.22, 5.67)
Oral Health Status Good/Fair/Poor vs. Excellent/Very Good	1.62 (1.10, 2.38)	Not included	1.70 (1.16, 2.49)
General Health Status Good/Fair/Poor vs. Excellent/Very Good	0.91 (0.58, 1.43)	Not included	0.93 (0.59, 1.46)
School Absence - Routine Dental Care 1 day vs. no days 2 days vs. no days 3 days vs. no days	0.76 (0.45, 1.27) 1.05 (0.52, 2.11) 0.95 (0.42, 2.16)	0.73 (0.44, 1.23) 1.06 (0.53, 2.10) 1.05 (0.46, 2.41)	Not included
School Absence due to Dental Pain Yes vs. No	1.68 (0.88, 3.20)	1.94 (1.04, 3.63)	Not included

Figure 1. Conceptual Framework

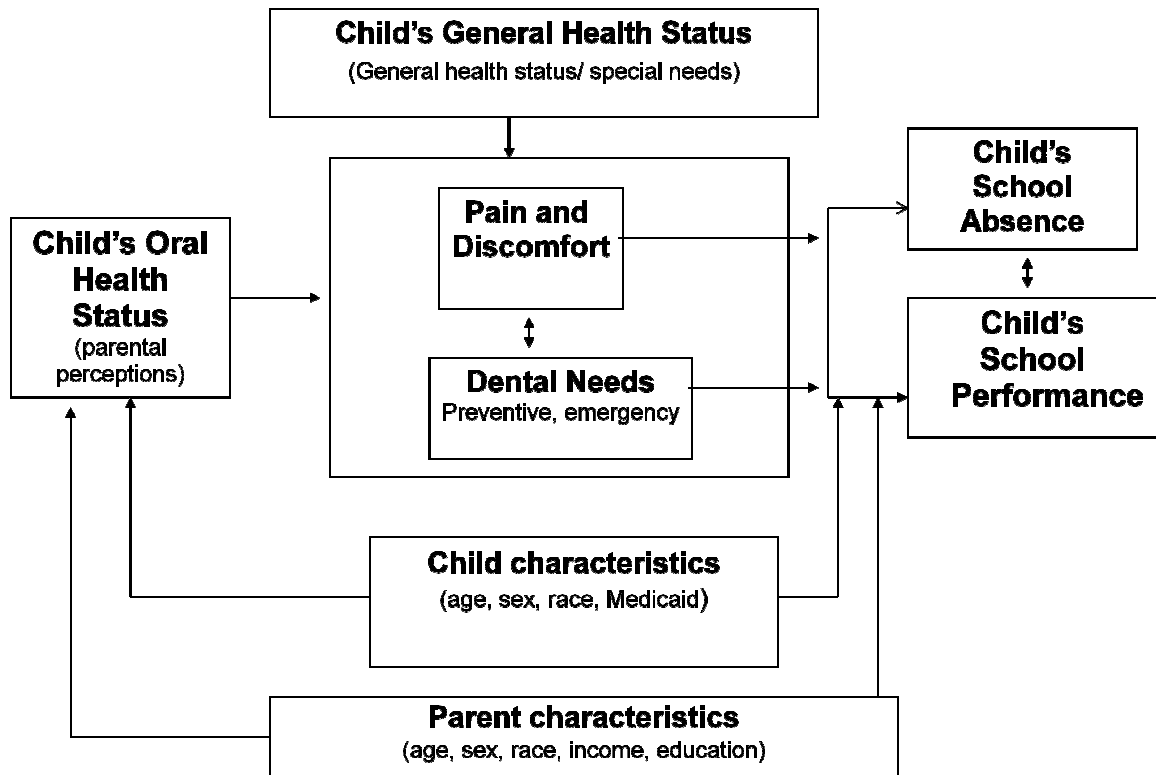


Figure 2. CHAMP 2008 Questions

School Performance

1. During the past 12 months, about how many days did (CHILD) miss school because of illness or injury? (____Number of Days)
2. Since starting kindergarten, has (he/she) repeated any grades? (Yes, No, Don't know/not sure)
3. How would you describe (CHILD'S) grades in school over the past 12 months? Would you say they were mostly... (A's, B's, C's, D's, or F's)

Oral Health

1. How would you rate the condition of (CHILD'S) teeth? Would you say their condition is: (Excellent, Very Good, Good, Fair, or Poor)
2. Does {he/she} have a dentist or dental clinic where {he/she} goes regularly? (Yes, No, Don't Know/not sure)
3. About how long has it been since (CHILD) last saw a dentist? Include all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists. (Never, 6 months or less, More than 6 months, but not more than 1 year ago, More than 1 year, but not more than 2 years ago, More than 2 years, but not more than 5 years ago, More than 5 years ago, Don't know/Not sure)
4. During the past 12 months, about how many days did your child miss school because of routine dental care (such as check-ups, fillings, etc.) or orthodontic visits? (____Days missed from school)
5. During the past 12 months, about how many days did your child miss school because of a tooth ache, dental infection or related 'dental fever'? Include time spent at home not feeling well and time receiving dental care for the problem. (____Days missed from school)

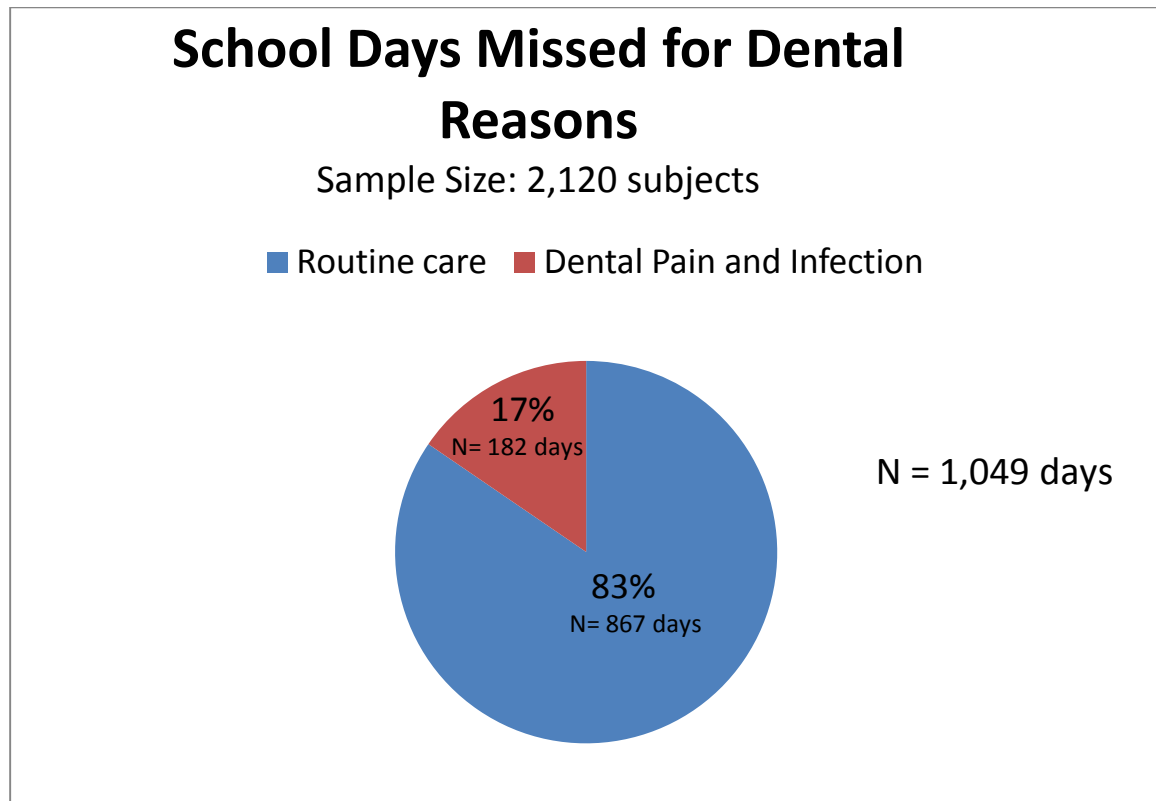
Asthma

7. During the past 12 months, how many days of daycare or school did (CHILD) miss due to asthma? (Days missed from school or daycare, N/A, Don't Know/Not Sure, Refused).

General Health

1. Would you say that in general (CHILD'S) health is: (Excellent, Very Good, Good, Fair, or Poor)

Figure 3. School Days Missed for Dental Reasons



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